REMARKS

Reconsideration and allowance of the above-referenced application are respectfully requested. Claims 1-6 and 11-14 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Mizutani in view of Funakoshi. In response, the claims are amended to emphasize their patentable distinctions.

As claimed, the invention specifies the crystal growth direction in a charge-coupled device and coincides with a direction of the charged transfer. This may produce advantages as described within the specification.

Arguments to this effect were made in the previous amendment, and in the response to the argument, the rejection alleges that applicants' claims do not preclude crystal growth in all directions. However, it is respectfully suggested that the claimed invention performs crystal growth in a particular direction by partially introducing a metal element. This is shown in FIGS. 5 and 6; page 4, lines 16-26; and page 5, line 27 through page 6, line 17. The crystal growth is controlled by partially adding the catalytic element (e.g., nickel) into a portion of the semiconductor film. A plurality of crystals are thus formed extending in a direction parallel to the substrate. That is, the crystal growth proceeds from a region where the catalytic element is introduced in the parallel direction.

Therefore, the crystal structure of the crystal and semiconductor film can be regarded as a single crystal for a carrier, and this carrier is not restricted for movement by a grain boundary.

This compares with the '785 patent, where FIGS. 7A-7C apparently show how the crystal grains grow in all directions at first (FIG. 7B) and then along the perpendicular direction to the substrate after the crystal grains contact each other (FIG. 7C). Even though Mizutani indicates there is a continuous film 73, there likely still are grain boundaries in this polycrystalline film. Therefore, the above is accurate. Funakoshi merely shows an example of a charged transfer device with vertical and horizontal charge-coupled layers. This does not teach or suggest nor render obvious the above.

Claims 16 and 19 stand rejected under 35 U.S.C. 103(a) as allegedly being unpatentable over Zhang, U.S. Patent No. 5,604,360, in view of Mizutani. Claims 17, 18, and 20-23 stand rejected under 35 U.S.C. 103(a) as being obvious over Zhang in view of Mizutani. This contention has again been obviated by the amendment of the claims herein. Zhang teaches a liquid crystal display device, while the present invention teaches a charge-coupled device in which the carriers move from a potential well to an adjacent well formed in the crystalline semiconductor film. That is, carrier moving direction is important in the

present application, because of reasons disclosed in the specification. Among other things, carriers could be trapped at the grain boundary. The same problem does not exist in the cited prior art, and thus it would not have been obvious to combine these references in the way cited.

In view of the above amendments and remarks, therefore, all of the claims should be in condition for allowance. A formal notice to that effect is respectfully solicited.

Please apply any charges or credits to Deposit Account No. 06-1050.

Respectfully submitted,

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VERSION TO SHOW CHANGES MADE

In the Claims:

Claims 1-3, 11, 16 and 19 have been amended as follows.

1. (Amended) A charge transfer semiconductor device comprising:

a crystalline semiconductor film having a plurality of crystals extending in a crystal growth direction;

a charge storing means including a plurality of photodetecting elements, each of said photodetecting elements being for storing a charge in accordance with an incident light; and

a charge transfer means for transferring the charge stored in the charge storing means,

<u>wherein a crystal structure of the crystalline semiconductor film is continuous in the crystal growth direction so that the crystal structure is regarded as single crystal for the charge,</u>

wherein a charge transfer direction of the charge transfer means is [arranged in] <u>coincident with</u> the crystal growth direction.

2. (Amended) A semiconductor device comprising:

a plurality of photodiodes being formed in a matrix on an insulating surface;

a plurality of vertical charge coupled devices on the insulating surface, said vertical charge coupled devices being connected with the plurality of photodiodes;

at least a horizontal charge coupled device on the insulating surface, said horizontal charge coupled device being connected with the vertical charge coupled device,

wherein [each of] at least one of the vertical and horizontal charge coupled devices comprises a crystalline semiconductor film having a plurality of crystals extending in a crystal growth direction,

wherein a crystal structure of the crystalline semiconductor film in the crystal growth direction is continuous so that a charge moving is not restricted by a grain boundary,

wherein a charge transfer direction of [each] at least one of the vertical and horizontal charge coupled devices is [arranged in] coincident with the crystal growth direction.

3. (Amended) A device according to claim 1,

wherein the crystalline semiconductor film is formed [on] over a quartz substrate, and

wherein [said] the incident light is made from a side of the quartz substrate.

11. (Amended) A device according to claim 2,

wherein the crystalline semiconductor film is formed [on] over a quartz substrate, and

wherein an incident light is made from a side of the quartz substrate.

16. (Amended) A semiconductor device comprising:

a crystalline semiconductor film being formed on an insulating surface, said crystalline semiconductor film having a plurality of crystals extending in a crystal growth direction which is parallel to the insulating surface;

an insulating film on the crystalline semiconductor film;

a plurality of electrodes being formed on the insulating film, each of said plurality of electrodes being located within a predetermined distance so that a plurality of MOS capacitors are formed between the plurality of electrodes and the crystalline semiconductor film with the insulating film therebetween,

wherein a charge is transferred from one of the MOS capacitors to another of the MOS capacitors in a charge transfer direction,

wherein a crystal structure of the crystalline semiconductor film is continuous so that the crystal structure is regarded as single crystal for the charge,

wherein [said] <u>the</u> charge transfer direction is [aligned] <u>coincident</u> with said crystal growth direction.

19. (Amended) A semiconductor device comprising:

a photoelectric conversion being formed over an insulating surface;

a charge coupled device being electrically connected to the photoelectric conversion device and formed over the insulating surface;

said charge coupled device including:

a crystalline semiconductor film being formed on the insulating surface, said crystalline semiconductor film having <u>a plurality of crystals extending in</u> a crystal growth direction which is parallel to the insulating surface;

an insulating film on the crystalline semiconductor film;

a plurality of electrodes being formed on the insulating film, each of said plurality of electrodes being located within a predetermined distance so that a plurality of MOS capacitors are formed between the plurality of electrodes and the crystalline semiconductor film with the insulating film therebetween,

wherein a charge is transferred from one of the MOS capacitors to another of the MOS capacitors in a charge transfer direction,

wherein a crystal structure of the crystalline semiconductor film in the crystal growth direction is continuous so that a charge moving is not restricted by a grain boundary,

wherein [said] the charge transfer direction is [aligned] coincident with [said] the crystal growth direction.